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# **Renewable Energy Transmission Initiative**

## **RETI Phase 1B – Executive Summary**

**DRAFT REPORT**

**November 2008**

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## Preface

RETI is a collaborative stakeholder planning process that was initiated as a joint effort among the California Public Utilities Commission (CPUC), the California Energy Commission (Energy Commission), and the California Independent System Operator (CAISO), together with publicly owned and investor owned utilities. RETI's work is undertaken by a 29-member Stakeholder Steering Committee (SSC) that involves a broad range of participants<sup>1</sup>, first to gather information and advice, and then to build active and consensus support for specific plans for renewable energy and related transmission development.

The ultimate goal of RETI's work is to identify major upgrades to California's electric transmission system needed to access competitive renewable energy zones (CREZs) sufficient to meet the state's energy targets. Phase 1 of this effort is to identify those CREZs that can be developed in the most cost effective and environmentally benign manner, as described in this draft report. Existing transmission planning processes to prepare transmission plans of service for priority CREZs will be used in Phases 2 and 3.

The Phase 1A report, accepted by the SSC on May 21, 2008, described the methodology, assumptions and resource information to be used in Phase 1B of RETI project.<sup>2</sup>

This Draft Phase 1B Report is a high-level screening analysis that applies the resource valuation methodology developed in Phase 1A. Potential renewable energy projects have been grouped into CREZs based on geographical proximity, development timeframe, shared transmission constraints, and additive economic benefits. As described in this draft report, CREZs have been ranked according to cost effectiveness, environmental impacts, development and schedule certainty, and other factors to provide a renewable resource base case for California. This analysis is undergoing review and refinement by the SSC, and will be further refined in Phase 2.

Phase 2 will refine the analysis for priority CREZs, including project siting constraints, and will develop a statewide conceptual transmission plan. Phase 3 will develop transmission plans of service to provide access to the grid for identified priority CREZs.

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<sup>1</sup> For a list of SSC members, see [http://www.energy.ca.gov/reti/steering/SSC\\_Member\\_List.pdf](http://www.energy.ca.gov/reti/steering/SSC_Member_List.pdf).

<sup>2</sup> The Phase 1A report is available at <http://www.energy.ca.gov/2008publications/RETI-1000-2008-002/RETI-1000-2008-002-F.PDF>. Note that this is a large file (9.9 megabytes.)

## Introduction

California's Renewable Energy Transmission Initiative (RETI) has completed its preliminary assessment of Competitive Renewable Energy Zones (CREZs)<sup>3</sup> which can provide renewable energy for the state. The purpose of this assessment is to inform RETI decisions regarding major electric transmission projects needed to access this energy and deliver it to California consumers. This report to the Stakeholder Steering Committee describes the economic and environmental assessments of California CREZs and other renewable energy resources in the West which have been performed and the results.

The economic and environmental CREZ assessment methodologies have been previously reported.<sup>4</sup> This draft report provides a brief summary of those methodologies, describes recent modifications to them, and the results. This report also describes RETI planning for identifying needed transmission facilities.

The CREZ assessment process has been guided by a diverse group of stakeholders who have given generously of their time and expertise. This analysis is believed to be the most thorough ever undertaken, and the results will provide a robust basis for planning transmission connections to major renewable resource areas.

## Economic Assessment of CREZs

The economic assessment of renewable energy resources focused on California, with less detailed analysis of resources in Nevada, Arizona, the border region of Baja California, and the Pacific Northwest including British Columbia. It was performed by Black & Veatch with the assistance of the Phase 1B Working Group. Their work is described in detail in the volume of this report entitled "Economic Assessment of Competitive Renewable Energy Zones." Maps and other supporting materials are available on the RETI web site.

The economic assessment estimates the cost of developing renewable resources throughout these areas and transmitting the energy to California consumers. In addition, the assessment estimates the value of this energy by considering the time of day and capacity value (firmness) of the resource. The difference between the estimated cost and value provides the basis for ranking the CREZs.

CREZ were identified based on density of resources in different areas, estimated cost of developing them, and shared transmission constraints. Using these considerations,

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<sup>3</sup> Previous RETI documents and other materials can be found on the RETI web site at <http://www.energy.ca.gov/reti/index.html>.

<sup>4</sup> Economic assumptions and assessment methodology are described in, "Renewable Energy Transmission Initiative Phase 1A Final Report," May 17, 2008; environmental assessment methodology is described in, "Interim Draft Phase 1B Report, August 15, 2008." Both reports are available at: [www.energy.ca.gov/reti/documents/index.html](http://www.energy.ca.gov/reti/documents/index.html).

Black & Veatch identified approximate geographic boundaries of each CREZ in California, as well as general areas within each CREZ deemed suitable for biomass, geothermal, solar and wind energy development.

CREZ areas have been identified with regard to areas specified by RETI's Environmental Working Group (EWG) as prohibiting or restricting energy development as a result of law and policies as described in the volume of this report entitled "Environmental Assessment of Competitive Renewable Energy Zones".

A CREZ may contain two types of projects: those known to be planned or proposed by renewable energy developers (referred to as "pre-identified" projects); and areas believed to be suitable for development but in which developers' interest is yet unknown (referred to as "proxy" projects).

An initial assessment identified resource areas sufficient to provide renewable energy far in excess of California's 2020 needs. At the direction of the Stakeholder Steering Committee, initial screening was performed to winnow the prospects to a more manageable number based on expected economic viability. As a result, 29 California CREZs capable of delivering total annual energy of approximately 200,000 gigawatt-hours per year (GWh/yr) were identified.<sup>5</sup> In addition, about 70,000 GWh/yr of smaller-scale non-CREZ resources were modeled in California. These included resources such as distribution-level solar photovoltaics and biomass projects which do not require large scale transmission upgrades. Finally, an additional 110,000 GWh/yr of resources were identified in other states, British Columbia and Baja California Norte. While there are significantly more resources potentially available out-of-state, these resource were modeled as the most economically competitive for imports.

CREZ are ranked on the basis of the *weighted average* cost and value of all the projects in each CREZ. While most of the CREZ's have relatively consistent technical and economic factors across the relatively small regions, high cost projects raise the average cost assigned to a CREZ. Lower cost projects are thereby disadvantaged by their geographic association with higher cost projects. To counter this issue, six of the California CREZs were divided into two "sub-CREZs" and one was divided into three sub-CREZs for a total of 37 distinct areas in California.

The RETI renewable energy target is the amount of additional renewable energy needed to provide 33 percent of California's electric energy consumption in the year 2020. This value is referred to as the RETI "net short" and is estimated to be about

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<sup>5</sup> Maps are available of the CREZ's at: <http://www.energy.ca.gov/reti/documents/index.html>. One gigawatt-hour equals 1,000 megawatt-hours (MWh). Total California electric demand in 2007 was approximately 240,000 GWh in 2007.

68,000 GWh/yr.<sup>6</sup> For purposes of identifying preferred California CREZs capable of supplying an adequate quantity of renewable energy for planning purposes, allowance has been made for uncertainties in the assessment, for the desirability of ensuring competition between developers of various technologies, and for the likelihood that some renewable energy will be imported from out of state. Accordingly, California CREZs with the best economic scores sufficient to supply about 100,000 GWh per year have been identified and are shown in Table ES-1 below.

<b>Table ES-1. Economic Ranking of California CREZs.</b>			
<b>CREZ Name</b>	<b>Annual Energy (GWh/yr)</b>	<b>Cumulative Energy (GWh/yr)</b>	<b>Weighted Average Rank Cost (\$/MWh)</b>
Solano	2,721	2,721	-29
Palm Springs	2,465	5,186	-20
Victorville-A	2,112	7,298	-17
Imperial North-A	10,095	17,393	-13
Round Mountain-A	1,598	18,990	-11
Fairmont	18,318	37,308	-9
Tehachapi	25,091	62,400	-3
Riverside East-A	2,339	64,739	3
Victorville-B	2,267	67,006	4
Kramer	16,251	83,257	5
Inyokern	7,136	90,393	8
Owens Valley	3,433	93,826	10
Lassen South-A	3,010	96,836	14
Twentynine Palms	1,944	98,779	15

The results of the economic assessment and the environmental assessment described below are intended only to guide initial planning of the transmission facilities necessary to meet state renewable energy goals. The assessments are not intended to usurp local, state or federal project permitting authority, nor to impinge on the ability of renewable energy to be developed in other areas.

<sup>6</sup> It is important to note that the Net Short accounts for existing and under-construction resources, contributions from the California Solar Initiative, and the generation from smaller renewable resources not assessed in RETI Phase 1B, such as landfill gas, hydro, and marine energy. For more information, refer to the volume "Economic Assessment of Competitive Renewable Energy Zones."

## Environmental Assessment of CREZs

At the direction of the SSC, the EWG assessed the environmental concerns associated with the CREZs identified by Black & Veatch and the renewable energy development areas within them. The EWG is chaired by the two environmental group representatives on the Stakeholder Steering Committee<sup>7</sup> and involved active participation by a large number of stakeholders. Details of the EWG assessment and the results are described in the “Environmental Assessment of CREZ” volume of this report.

The EWG previously identified areas in which energy development is prohibited or significantly restricted by law or policy.<sup>8</sup> The CREZs identified by Black & Veatch were designed to be consistent with these restrictions.

Initially CREZ outlines were roughly drawn to surround identified development areas and associated connecting power lines, but these initial outlines were deemed to be unduly arbitrary and unnecessarily large for assessment purposes. In response, Black & Veatch shrank the outlines to the minimum area required to encompass the development areas and associated connecting transmission lines, a process referred to as “shrink-wrapping” the CREZ boundaries. These smaller and more focused outlines were the CREZ boundaries used by the EWG in its assessment. A two mile buffer zone was also identified for each CREZ, and the area of concern associated with transmission lines was extended one-half mile on both sides of the line.

Of the 37 California CREZs and sub-CREZs identified by Black & Veatch, only 30 of the most cost effective areas were assessed by the EWG due to technical reasons which could not be resolved in time for this draft report.

Environmental concerns are considerably more difficult to quantify than the factors used in the economic assessment. Nevertheless, some quantification of these concerns is required to objectively compare CREZs. The EWG assessment relies on publicly available data sources together with formulas which use the data to provide a numerical indication of the relative level of concern for each California CREZ for each of eight different criteria.

The numerical values are intended only to indicate relative levels of concern. Their relative magnitudes have been used for purposes of comparing CREZs. They do not and cannot represent actual environmental impacts.

Eight criteria were identified by the EWG for comparing the relative environmental sensitivity of the California CREZs, as described in Section 4 of the

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<sup>7</sup> EWG co-chairs are Johanna Wald of the Natural Resources Defense Council and Carl Zichella of the Sierra Club.

<sup>8</sup> For a complete description of these laws and policies, see Section 2 of the Environmental Assessment volume.



Environmental Assessment volume. In general, these criteria are designed to identify those CREZs which:

- disturb the least amount of land per unit of energy output, including land needed to collect and transmit that energy to the existing transmission grid;
- minimize potential conflicts with areas of special environmental concern;
- minimize potential impacts on wildlife and significant species; and
- maximize the use of previously disturbed lands.

In addition to the CREZ information provided by Black & Veatch, statewide datasets were identified to provide an objective basis for evaluating each of the eight criteria chosen by the EWG. The EWG devised formulas to translate the appropriate data for each CREZ into quantitative values, the magnitudes of which are indicators of the level of environmental concern associated with each CREZ and each criterion. Lower values given by the formulas are taken to represent relatively less concern. These values provide the basis for ranking the CREZs according to the relative levels of environmental concern.

Throughout the process of developing the criteria formulas and devising the ranking methodology, the identities of the CREZs have remained unknown to EWG participants. This anonymity was essential to preserve the objectivity of the results. Sensitivities have been performed with modified formulas and ranking methodologies to ensure that the results are robust against minor changes.

The eight ranking scores for each CREZ were then summed to provide a total ranking score of relative environmental concern for each CREZ. The best-scoring CREZs sufficient to provide nearly 100,000 GWh per year in the environmental assessment are identified in Table ES-2 below:

**Table ES-2. Environmental Ranking of California CREZs.**

<b>CREZ Name</b>	<b>Annual Energy (GWh/yr)</b>	<b>Cumulative Energy (GWh/yr)</b>	<b>Environmental Ranking Score</b>
Imperial North-A	10,095	10,095	2.1
Fairmont	18,318	28,412	4.1
Twentynine Palms	1,944	30,356	4.3
Tehachapi	25,091	55,447	4.3
Pisgah-A	4,283	59,731	4.8
Mountain Pass	6,942	66,673	5.2
Victorville-A	2,112	68,785	5.3
San Bernardino - Lucerne	10,722	79,506	5.4
Kramer	16,251	95,758	5.4
Palm Springs	2,465	98,223	5.9

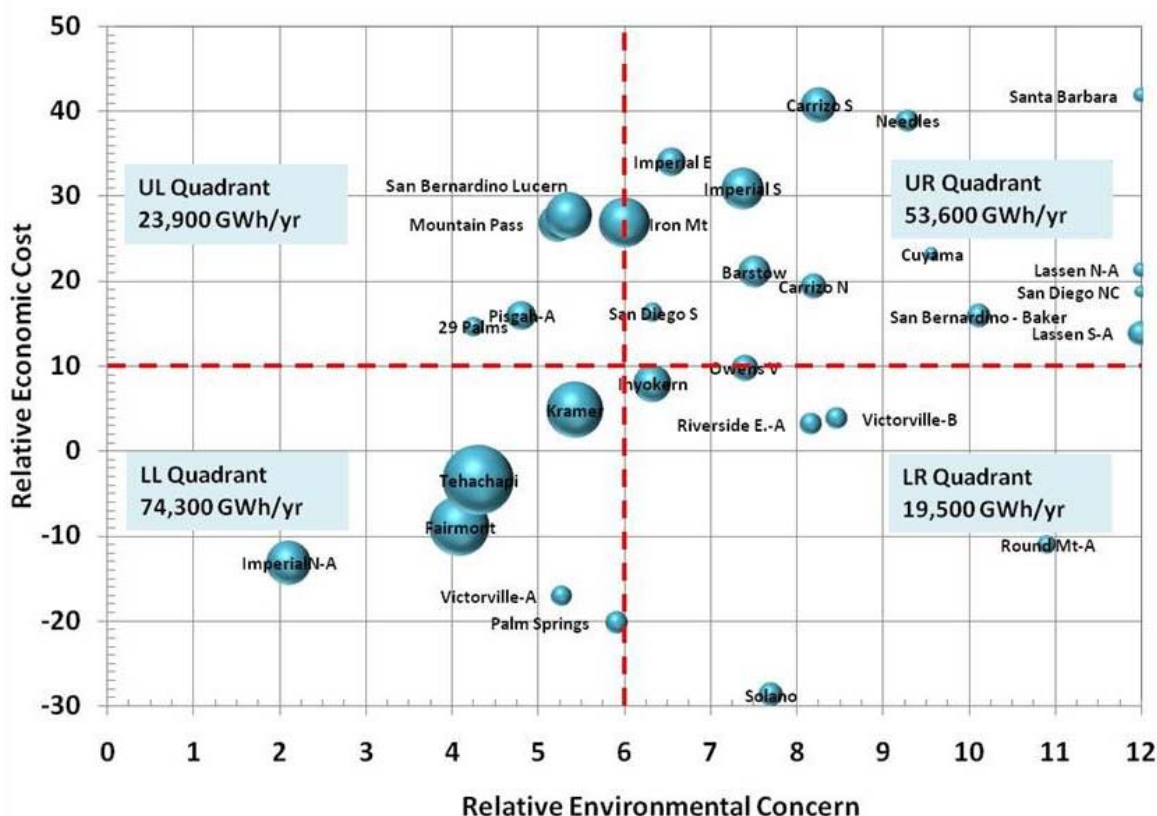
The CREZs identified above are those believed to be those in which energy development would minimize environmental concerns as judged by the data used in the analysis. Ranking scores are not intended to represent the level of concern in any individual project which may occur within a CREZ. The EWG CREZ ranking process is not intended in any way to substitute for a thorough environmental review of proposed projects as required by the California Environmental Quality Act (CEQA) or the National Environmental Policy Act (NEPA).

Instead, incorporating environmental concerns into CREZ ranking is intended to anticipate environmental concerns associated with energy development and the transmission facilities needed to access these areas, thereby facilitating approval. CREZs able to be developed at the least economic cost and least environmental concern present the strongest case for approval of new transmission facilities.

## **Combined Assessment of CREZs**

The economic and environmental CREZ ranking processes are based on two different concerns; the former attempts to minimize economic concerns, while the latter attempts to minimize environmental concerns. Since the assessments are based on different metrics, it is impossible to develop a single formula for combining the two sets of results.

Nevertheless, the Stakeholder Steering Committee is faced with the task of recommending new major transmission facilities needed to access needed renewable energy. To assist them in this task, the combined results are displayed in Figure ES-1 below.



**Figure ES-1. Economic and Environmental Assessment of California CREZs.**  
*Circle size is proportional to CREZ energy potential (GWh/yr)*

The division of the bubble chart in Figure ES-1 into quadrants is for discussion purposes only and is not intended to pre-judge decisions to be made by the Stakeholder Steering Committee.

CREZs in the lower left quadrant have the lowest (best) combination of economic and environmental ranking scores. These six CREZs have an estimated energy potential of 74,300 GWh/yr. It is noteworthy that three major transmission projects to access some of these areas are already being built or planned—the Tehachapi Renewable Transmission Project, whose first phase is under construction by Southern California Edison, the Sunrise Powerlink proposed by SDG&E, and Green Path North proposed by Los Angeles Department of Water and Power.

The CREZs in the lower right quadrant have economic ranking scores as low (good) as those in the lower left but have higher (worse) environmental ranking scores. These six CREZs are all relatively small, having a total estimated energy potential of about 19,500 GWh/yr. The extent to which major new transmission facilities would be needed to access these areas is to be examined by the Stakeholder Steering Committee.

The CREZs in the upper left quadrant have environmental ranking scores comparable to those in the lower left but have higher (worse) economic ranking scores. These four CREZs have an estimated energy potential of 23,900 GWh/yr.

The CREZs in the upper right quadrant received relatively poor ranking scores in both assessments. These 14 CREZs have an estimated energy potential of 53,600 GWh/yr. Four of these had environmental ranking scores higher than 12 and are shown on the edge of the chart.

Some additional general features of the assessment results can be seen in Figure ES-1. CREZs receiving lower (better) environmental ranking scores—those on the left hand side of the chart—tend to have more energy potential than CREZs receiving higher scores. Evidently the criteria used by the EWG favor larger and more energetic resource areas.

A second observation is that only eight of the CREZs assessed would be interconnected to the northern section of the California transmission grid.<sup>9</sup> All of these CREZs have relatively high environmental scores and appear on the right side of the chart. Of these only two—Solano and Round Mountain—received relatively good economic scores and appear in the lower right quadrant. The total energy potential of all eight CREZs is less than 20,000 GWh/yr, only 11 percent of the total, reflecting the fact that a large majority of the remaining California high-density renewable energy potential is found in Southern California.<sup>10</sup>

## **Renewable Resources Outside California**

With the exception of Nevada geothermal resources (which are “points” by their nature), the CREZ identification and delineation process used by Black & Veatch for areas outside California was less detailed than that used for areas inside the state. In addition, the EWG was unable to obtain environmental data for out of state resources comparable to that available for California. As a result, the EWG was unable to assess out of state resources on a basis comparable to the assessment of California CREZs.

The absence of an environmental assessment for out of state renewable resources is not intended to indicate that these resources are unimportant. On the contrary, these resources are expected to play an important role in satisfying California’s energy needs. The EWG will continue to search for sources of data and to develop a methodology which could be used to compare out of state resources to California CREZs for use by the SSC in transmission decisions.

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<sup>9</sup> Carrizo North and South, Solano, Round Mountain, Santa Barbara, Cuyama, Lassen North and South.

<sup>10</sup> There are, however, significant biomass and solar photovoltaic resources in Northern California. These resources are generally distributed and do not require large transmission upgrades.

Economically, there appear to be out of state resources that could justify the cost of new transmission construction and still be competitive with in-state California resources. An additional 110,000 GWh/yr of resources were identified in Arizona, Nevada, Oregon, Washington, British Columbia and Baja California Norte. Of these, about 15,000 GW/yr were considered competitive with California CREZs in the base case economic assessment, as summarized in Table ES-3.<sup>11</sup> These resources include wind and geothermal in British Columbia, geothermal in Oregon and Nevada, and wind resources in Baja California Norte. Wind resources in Mexico look particularly promising, and more study is recommended to refine the economic estimates and the environmental factors.

**Table ES-3. Cost-Competitive Out-of-State Resources.**

<b>Region</b>	<b>Capacity (MW)</b>	<b>Annual Energy (GWh/yr)</b>	<b>Weighted Average Rank Cost (\$/MWh)</b>
Oregon	392	2,848	-19
Nevada	523	2,976	-19
Baja California Norte	2,368	7,633	-11
British Columbia	340	1,553	-9

## Next Steps in the RETI Process

RETI Phase 2 will focus on conceptual transmission planning to identify the most effective ways to connect priority CREZ to the statewide and WECC grids and, more importantly, to do so in ways that enhance the grid to make renewable power deliverable to consumers. In Phase 3, RETI stakeholders will then work with publicly- and privately-owned utilities and the CAISO to translate conceptual transmission plans into detailed plans of service for commercial transmission projects that can be presented to the CPUC, POU governing boards and City Councils for approval.

The RETI SSC has formed a Phase 2 Work Group to oversee conceptual transmission planning for priority CREZ. The draft work plan intended to guide Phase 2 planning is posted on the RETI website. The CAISO will coordinate this work, with active participation of both POU and IOU Load Serving Entities, renewable energy generators and environmental groups. Power flow modeling to evaluate the electrical effects of different conceptual connections will be performed by participating

<sup>11</sup> Additional out-of-state resources are economic under certain sensitivity scenarios examined in the economic assessment.

transmission owners. Phase 2 will not identify specific geographic transmission routes, but the RETI EWG will conduct a high-level environmental assessment of conceptual transmission routes. Phase 2 is expected to conclude in the second quarter of 2009. Phase 2 results will be incorporated into the CAISO 2009 Transmission Planning Process for detailed engineering evaluation.

## **Comments on this Draft Report**

The CREZ identification and ranking contained in this draft report summarize the results of Phase 1 of the RETI initiative. The report will be considered by the RETI SSC and presented to the public in a meeting of the RETI Plenary Stakeholder Group. Comments on the report and all aspects of RETI Phase 1 will be accepted, on the schedule outlined below, and the report modified as found to be appropriate by the SSC. A Phase 1 Final Report and final CREZ ranking will then be presented for acceptance by the SSC.

- November 5, 2008: Draft Phase 1B Report posted on the RETI website.
- November 12, 2008, 9:00AM - 12:00 Noon: RETI Plenary Stakeholder Group public meeting to review the draft report with the RETI SSC, Black & Veatch, and the Environmental Work Group. Instructions for joining this web conference meeting are posted on the RETI website.
- November 19, 2008: Comments on the draft report due.

To submit comments on any aspect of the draft report, send them to:

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All comments received will be considered in preparation of the Phase 1B Final Report and will be posted on the RETI website.